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THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TES--ETC(U)
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UNCLASSIFIED ARL/AERO-TM-312 NL

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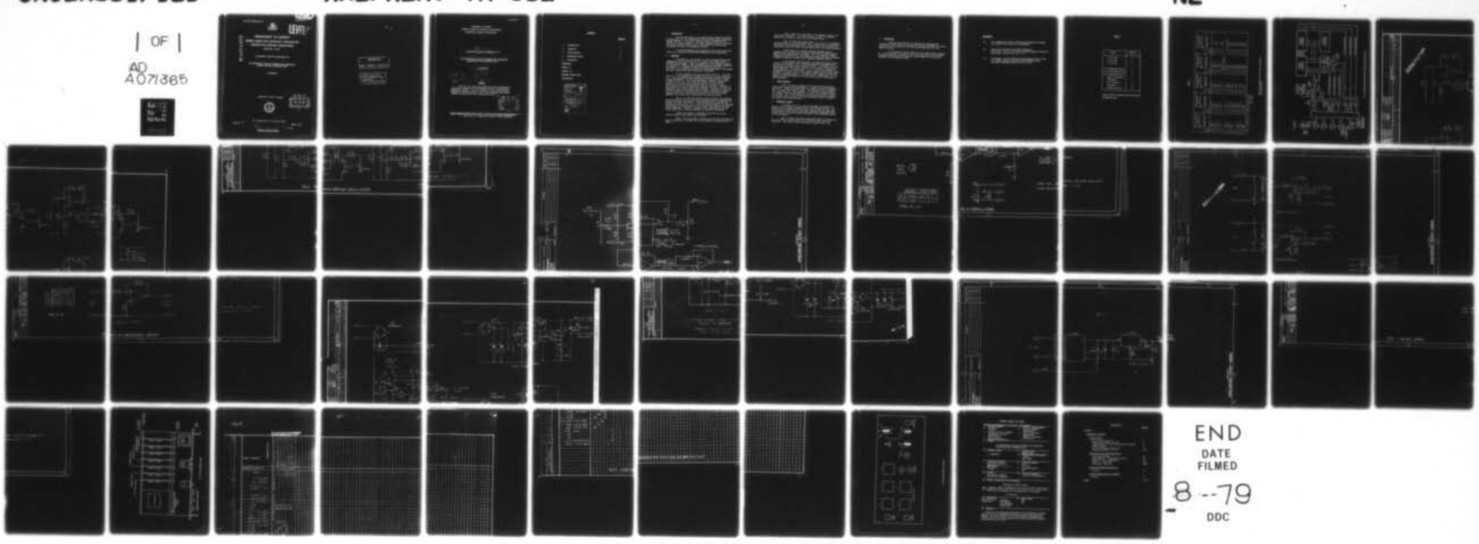

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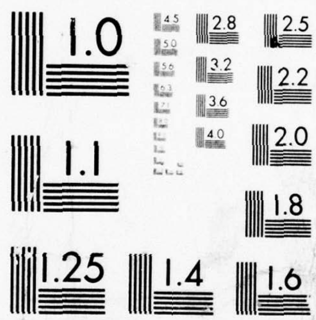
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1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

ARL-AERO-TECH-MEMO-312

AR-001-601

LEVEL II

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DEPARTMENT OF DEFENCE

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MELBOURNE, VICTORIA

Aerodynamics Technical Memorandum 312

THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TEST AND CALIBRATION UNIT.

P. FERRAROTTO

Approved for Public Release.

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MARCH, 1979

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Aerodynamics Technical Memorandum 312

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THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TEST AND CALIBRATION UNIT

10 P. FERRAROTTO

11 Mar 79 12 50 p.

14 ARL/AERO-TM-312

SUMMARY

This unit was constructed specifically for the purpose of testing and calibrating the Aerodynamics Division Airborne Data Acquisition Package. The unit consists of sine wave generators, modulators and miscellaneous circuits which generate test signal outputs for checking the data acquisition system.

POSTAL ADDRESS: Chief Superintendent, Aeronautical Research Laboratories, Box 4331, P.O., Melbourne, Victoria, 3001, Australia.

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CONTENTS

1. INTRODUCTION

The unit described in this memorandum was designed and built in conjunction with the Aerodynamics Division Airborne Data Acquisition Package (ADADAP). It provides a means by which the ADADAP can be checked for correct operation. The output signals of the unit simulate the various analogue signals which would normally be derived from transducers on board an instrumented aircraft.

A brief description of the operation of the unit and circuit details are included in ~~the following sections of~~ this memorandum.

2. OPERATION

The ADADAP (1) was designed to record analogue signals from transducers, some of which give a d.c. output, while others give a modulated 400 Hz output. This unit supplies all the necessary signals to simulate the output of these transducers and also provides a positive and negative d.c. reference voltage for calibration purposes; in particular, the calibration of the conditioning amplifiers in the ADADAP for gain, offset, drift and reliability of operation.

A block diagram of the unit is shown in Fig. (1). The sine waves at preset frequencies are generated using Wein Bridge oscillators (2). These sinusoidal outputs simulate the varying outputs of direct coupled transducers. The circuitry employed to produce these signals is shown in Fig. (2). One of the Wein Bridge circuits produces a 400 Hz sine wave which was originally used as a carrier and was modulated by each of the other three frequency sinusoids. However, in the aircraft for which the ADADAP was designed, the 400 Hz 115 volts is generated using a single phase rotary inverter. Therefore in this unit the 400 Hz carrier is generated with an aircraft single phase rotary inverter rather than a solid state oscillator so as to more nearly simulate the actual carrier conditions of an aircraft system.

Each of the three sinusoidal signals mentioned above modulate the 400 Hz carrier and the three resulting signals serve to simulate the signals from Linear Variometers. The circuitry used to provide this function is shown in Fig. (3). A built-in Linear Variometer (LV) provides the facility for modulating the 400 Hz carrier other than at the three fixed frequencies. Also the LV output is more representative of the actual signal from a similar transducer installed in an aircraft.

A Three Wire Synchro. Transmitter powered by the rotary inverter produces yet another type of signal.

Table 1 lists the signals available from the unit and these are given a type number (1 through 11) for the purpose of identification in Table 2.

Table 2 shows the connections of the signals to each of the five output connectors. It is seen from Fig. 1 that two different signals can be placed on some pins of the output plugs.

Fig. (1) shows that signal types, 1, 2, 3, 4, 5, 6, 9 and 11 can be switched to the distribution board. Signal type 7 is permanently available on the distribution board. Signals type 8 and 10 bypass the distribution board and connect to allocated pins on the output connectors.

Signal type 9 is a bipolar reference voltage which is available at the distribution board for the purpose of calibrating the direct coupled amplifiers in the ADADAP. Fig. (4) shows the voltage reference circuit which uses two temperature stabilized LM399 integrated circuits to provide a positive and a negative reference voltage.

A few seconds after switch-on, the three sine waves (types 1, 2 and 3) are available at the distribution board and consequently on the pins of the output plugs as shown on Table 2. The delay is for the Wein Bridge Oscillators (which provide the sine waves) to attain full output amplitude. If signals type 4, 5, 6, 7 and 11 are required, it is necessary to turn on the rotary inverter using the front panel switch provided. For signal type 10, an external signal needs to be fed into the two connectors provided on the front panel. Specifically, for the ADADAP this external signal is a 70 Hz sine wave of 20 volts peak-to-peak amplitude.

3. POWER SUPPLIES

Fig. (5) shows a standard ±5 volt supply printed circuit board used to power the three modulator circuits, sine wave generators and the d.c. voltage reference board. An additional +28 volt supply Fig. (6) powers the rotary inverter. The internal starting current of the rotary inverter is approximately 1.2 amps. with a running current of 0.6 amps. The +28 volt supply contains large capacitors to supply the initial surge in current without a significant drop in voltage at the input to the rotary inverter.

4. MECHANICAL LAYOUT

A standard 483 X 177 X 418 mm instrument case houses the printed circuit boards, transformers etc. that make up the unit. All circuits are on standard M8 size printed circuit cards and slide into 56 pin Cannon printed circuit board edge connectors along guide rails. Printed circuit boards are easily accessible via the removable section of the back panel.

Fig. (7) shows the general mechanical layout of the unit and Fig. (8) shows the inter-wiring of the printed circuit board edge connectors. The layout of the front panel is shown in Fig. (9).

5. CONCLUSIONS

This unit has proved to be valuable for simulating the transducers outputs which are required for checking the ADADAP for correct operation and for calibrating the conditioning amplifiers for gain, offset and drift.

The distribution board inside the unit gives greater flexibility, in that most of the outputs to the front panel plugs can be changed by simply unsoldering and reconnecting those outputs to the required signals on the distribution board.

REFERENCES

(1) The Aerodynamics Division Airborne Data Acquisition Package, A.J. Farrell, Aero. Note (To be published).

(2) Simple Low Distortion Wein Bridge Oscillator, R.N. Caffin, C.S.I.R.O. Division of Textile Physics, Electronic Engineering, October 1975, pp. 13-15.

(3) Synchronous and Non-Synchronous Rectification with Op. Amp., W.J. Macken, Regional Technical College Dundalk, Eire, Electronic Engineering March 1973, pp. 18-19.

TABLE 1

SIGNAL	TYPE NO.
1.6 Hz sine	1
3.0 Hz sine	2
5.8 Hz sine	3
1.6 Hz Modulated 400 Hz	4
3.0 Hz Modulated 400 Hz	5
5.8 Hz Modulated 400 Hz	6
Three Wire Synchro	7
Temperature	8
D.C. Reference	9
Tachometer	10
Linear Variometer	11

SIGNAL OUTPUTS AVAILABLE FROM THE TEST AND CALIBRATION UNIT.

TABLE 2

CHASSIS MOUNTING PLUG 1 TYPE KPT 00A14 19P		CHASSIS MOUNTING PLUG 2 TYPE KPT 00A14 19P		CHASSIS MOUNTING PLUG 3 TYPE KPT 00A14 19P		CHASSIS MOUNTING PLUG 4 TYPE KPT 00A14 19P		CHASSIS MOUNTING PLUG 5 TYPE KPT 00A14 19P	
PIN	SIGNAL TYPE	PIN	SIGNAL TYPE	PIN	SIGNAL TYPE	PIN	SIGNAL TYPE	PIN	SIGNAL TYPE
A	1 & 9*	A	1 & 9Δ	A	11 & 6	A	11 & 6	A	7
B	GND	B	GND	B	GND	B	GND	B	7
C	1 & 9*	C	2 & 9·	C	11 & 4	C	11 & 5	C	GND
D	GND	D	GND	D	GND	D	GND	D	7
E	2 & 9*	E	3 & 9·	E	11 & 4	E	11 & 4	E	7
F	GND	F	GND	F	GND	F	GND	F	GND
G	2 & 9*	G	3 & 9·	G	11 & 4	G	400 Hz (From Rot. Inverter)	G	10
H	GND	H	GND	H	GND	H	GND	H	GND (TACHO)
J	1 & 9*	J	1 & 9Δ	J	11 & 4	J	N/C	J	N/C
K	GND	K	GND	K	GND	K	N/C	K	N/C
L	1 & 9*	L	1 & 9Δ	L	11 & 4	L	N/C	L	N/C
M	GND	M	GND	M	GND	M	N/C	M	N/C
N	8	N	2 & 9*	N	5	N	N/C	N	N/C
P	8	P	GND	P	GND	P	N/C	P	N/C
R	1 & 9*	R	3 & 9*	R	11	R	N/C	R	N/C
S	GND	S	GND	S	GND	S	N/C	S	N/C
T	1 & 9Δ	T	3 & 9*	T	11	T	N/C	T	N/C
U	GND	U	GND	U	N/C	U	N/C	U	N/C
V	N/C	V	N/C	V	N/C	V	N/C	V	N/C

For * Value of d.c. voltage is ±3.5 volts
Δ " " " " " ±0.5 volts
. " " " " " ±0.6 volts

TEST AND CALIBRATION UNIT OUTPUT CONNECTOR PIN ALLOCATIONS.

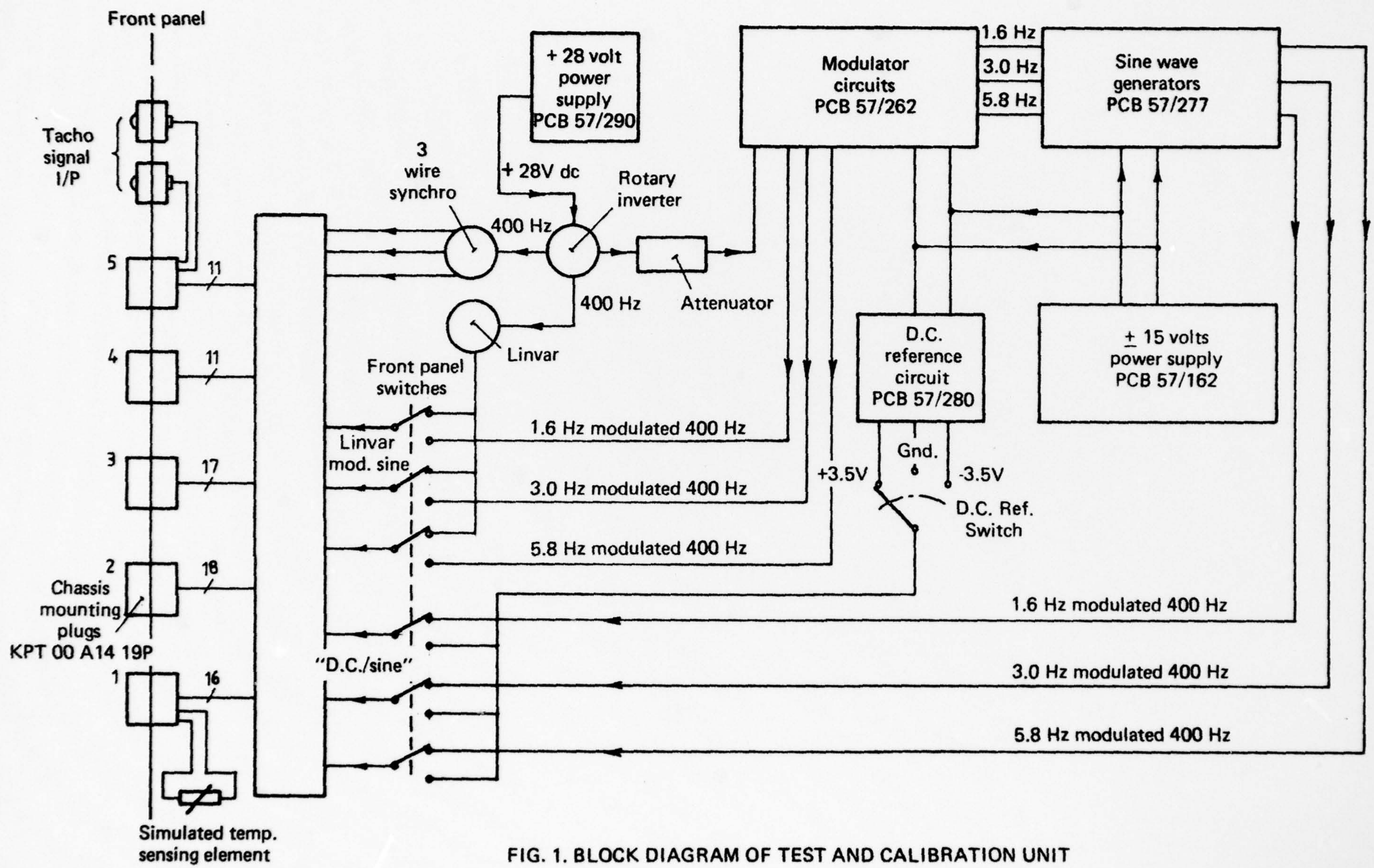
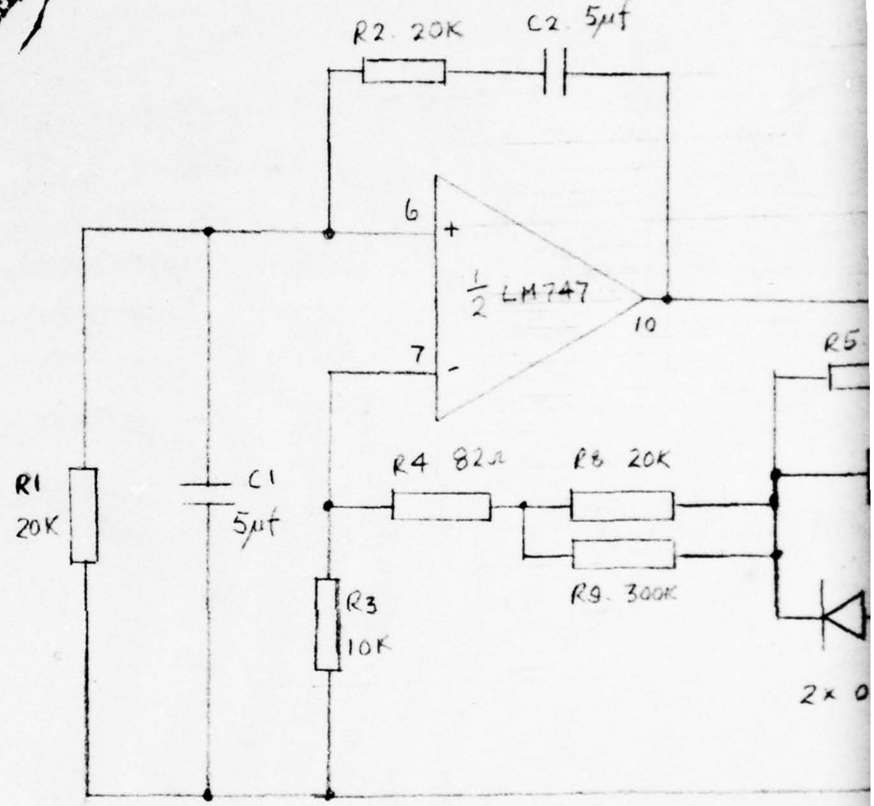
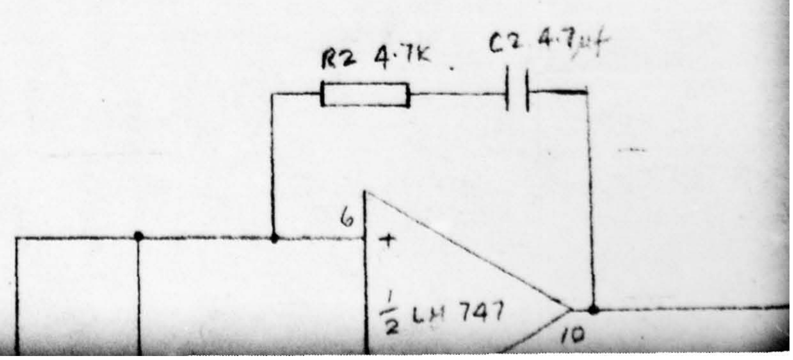
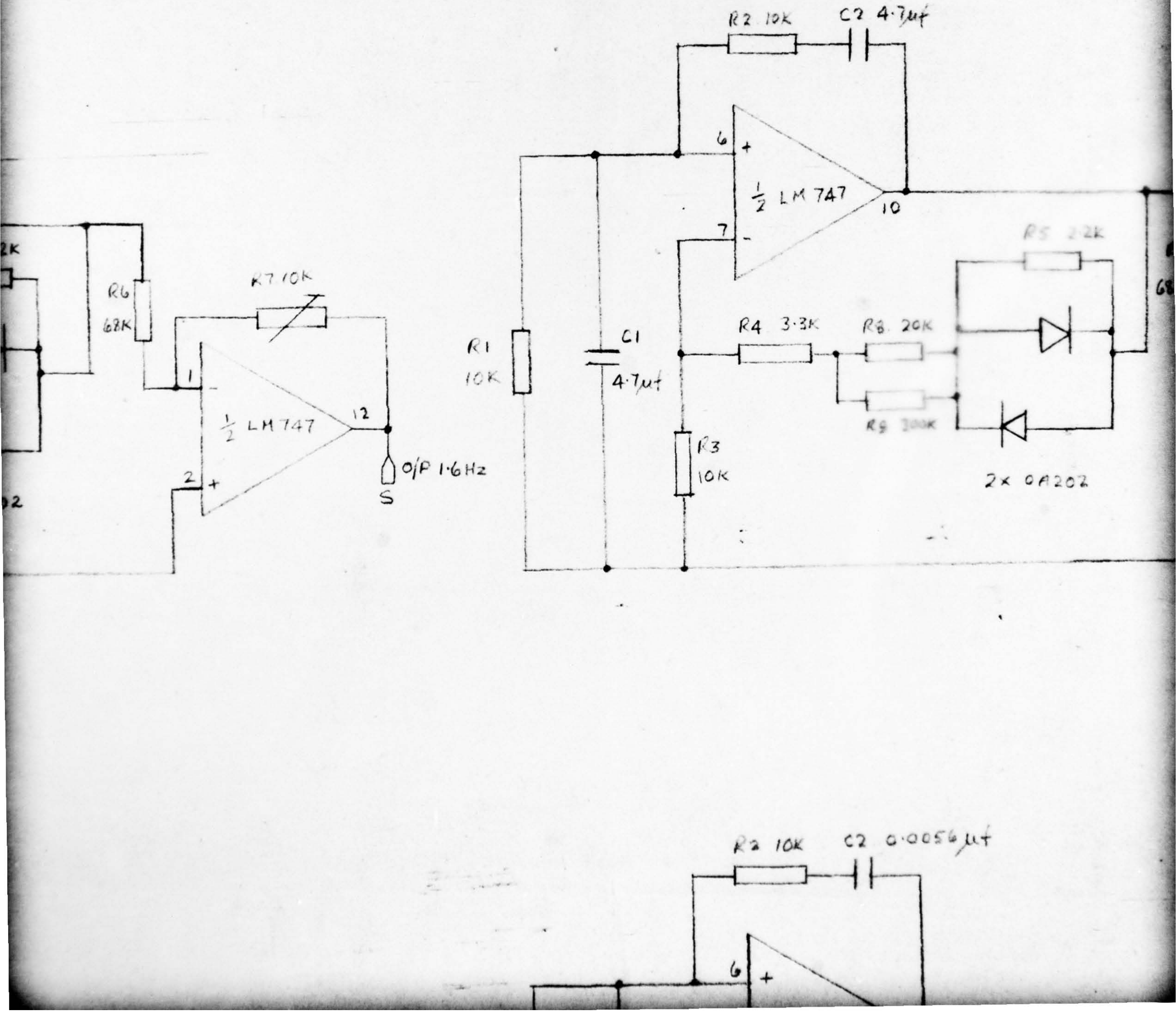


FIG. 1. BLOCK DIAGRAM OF TEST AND CALIBRATION UNIT


R2 20K
C2 5μf
6
+
1/2 LM747
10
7
-
R4 82Ω
R8 20K
R1
20K
C1
5μf
R3
10K
R9 300K


R2 4.7K
C2 4.7μf
6
+
1/2 LM 747
10


R2 10K
C2 4·7μf
6
+
1/2 LM 747
10
7
-
R5 2·2K
R7 10K
R6
68K
1
-
1/2 LM 747
12
2
+
O/P 1·6Hz
S
R1
10K
C1
4·7μf
R4 3·3K
R8 20K
R9 300K
R3
10K
2x OA202
2K
68
R2 10K
C2 0·0056μf
6
+

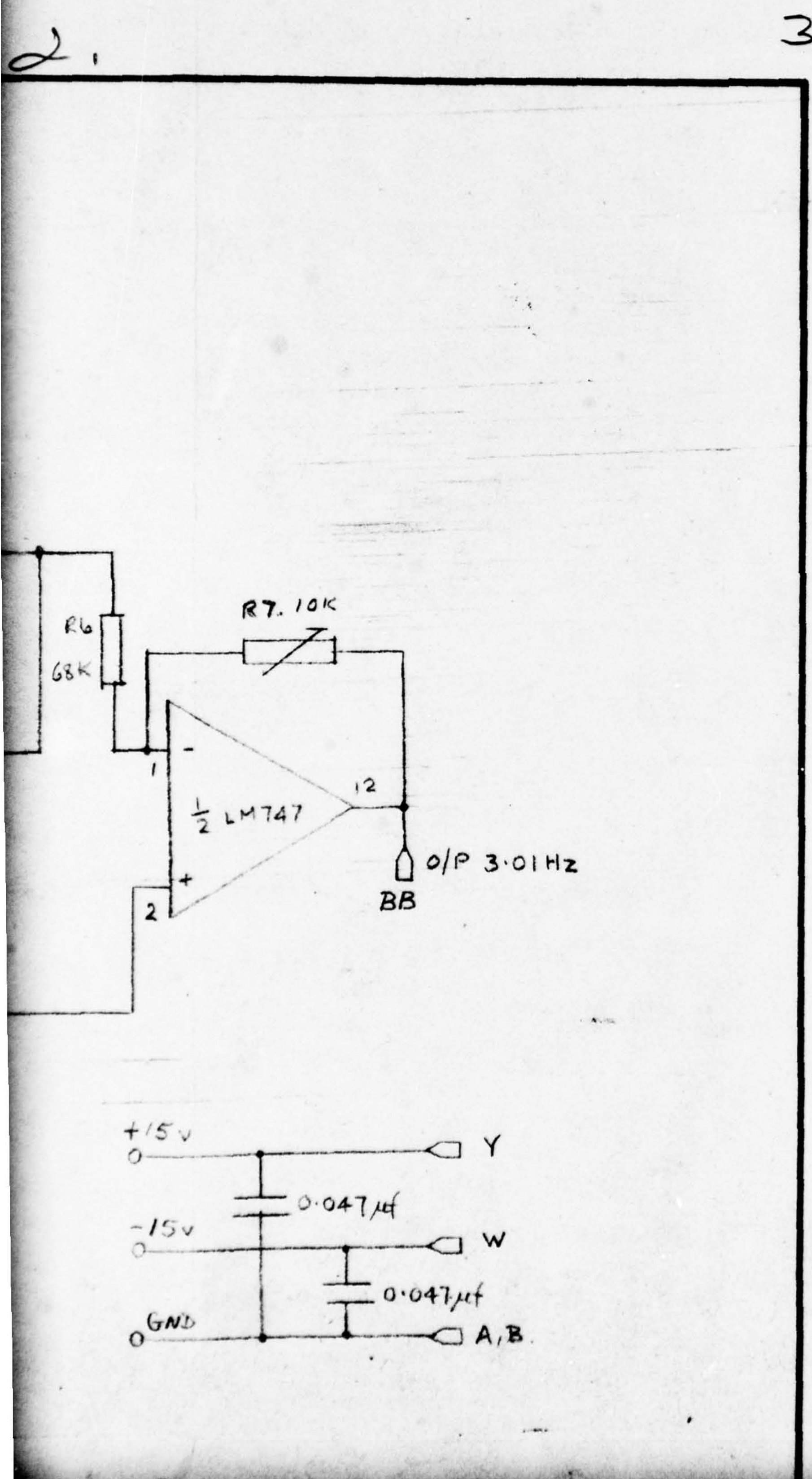

2.
3
R6
68K
R7. 10K
1
2
12
1/2 LM747
O/P 3.01Hz
BB
+15v
-15v
GND
0.047µf
0.047µf
Y
W
A,B.

FIG. 2

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REVISION	App.
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12.1.77	

SCALE

DRG. No.

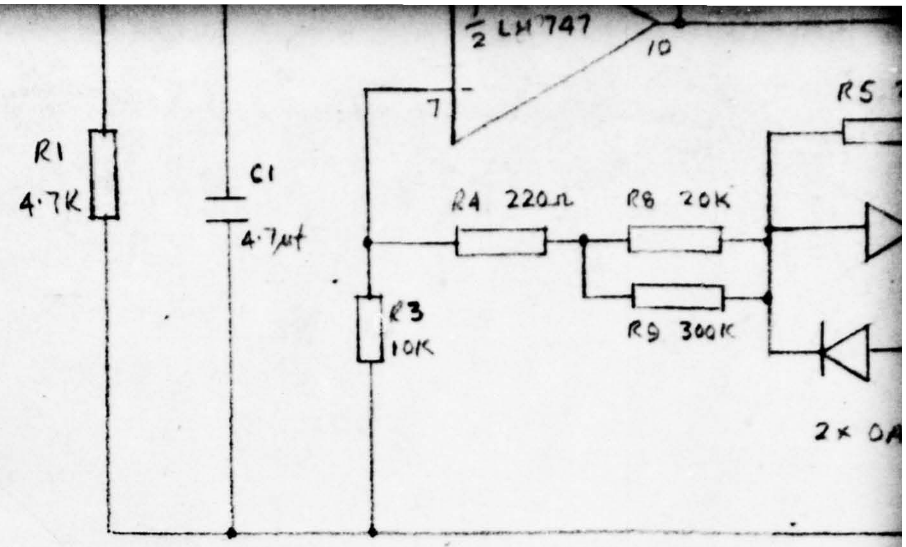
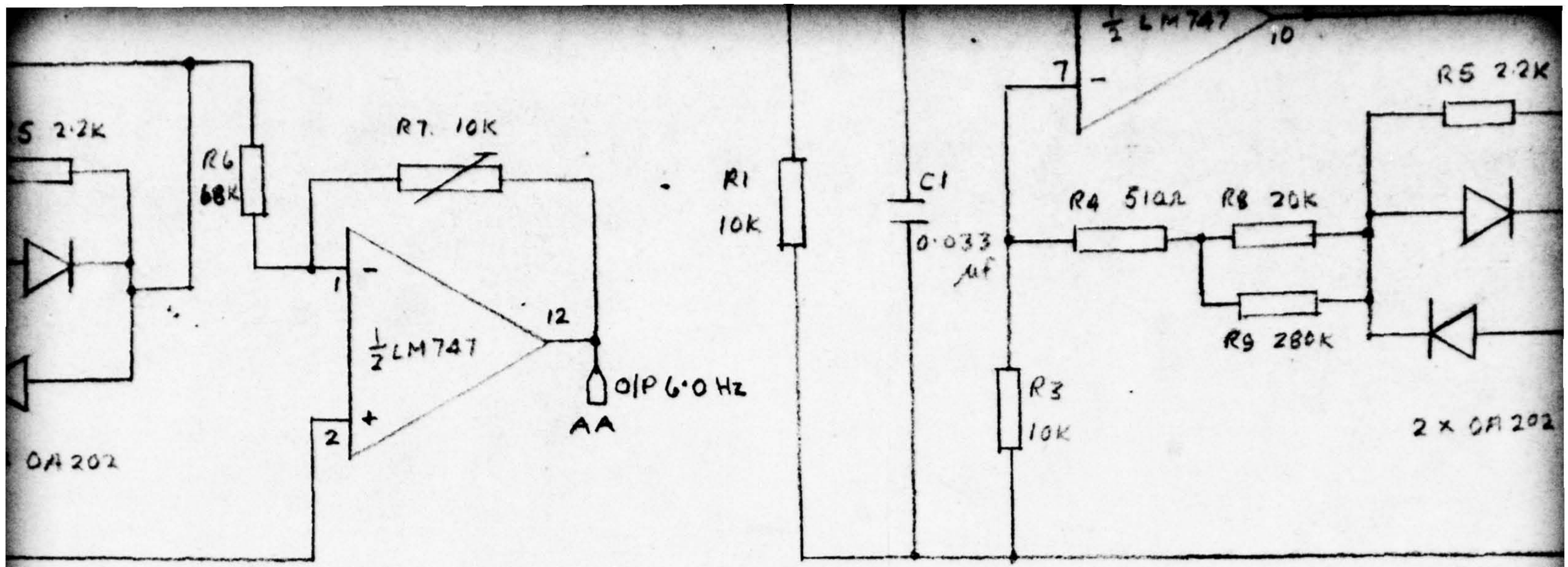


FIG 2 W

4

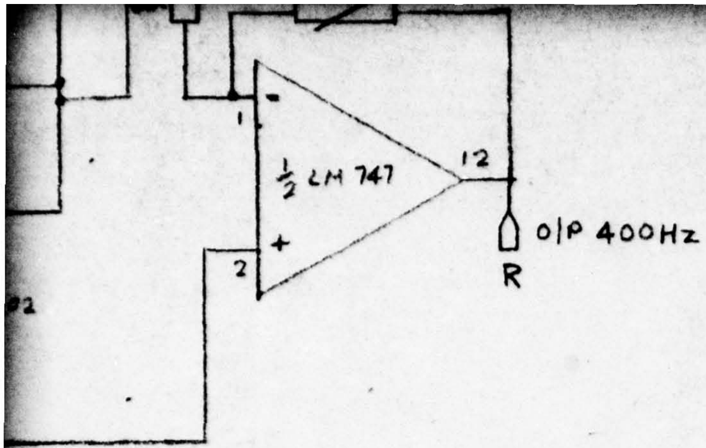


BOAR

BOAR

WEIN BRIDGE OSCILLATORS

5



ARD NAME - WEIN BRIDGE OSCILLATOR

ARD IDENTIFICATION - 57-277

6

No	DATE	APP

REVISION

TOLERANCES

ALL DIMEN... IN

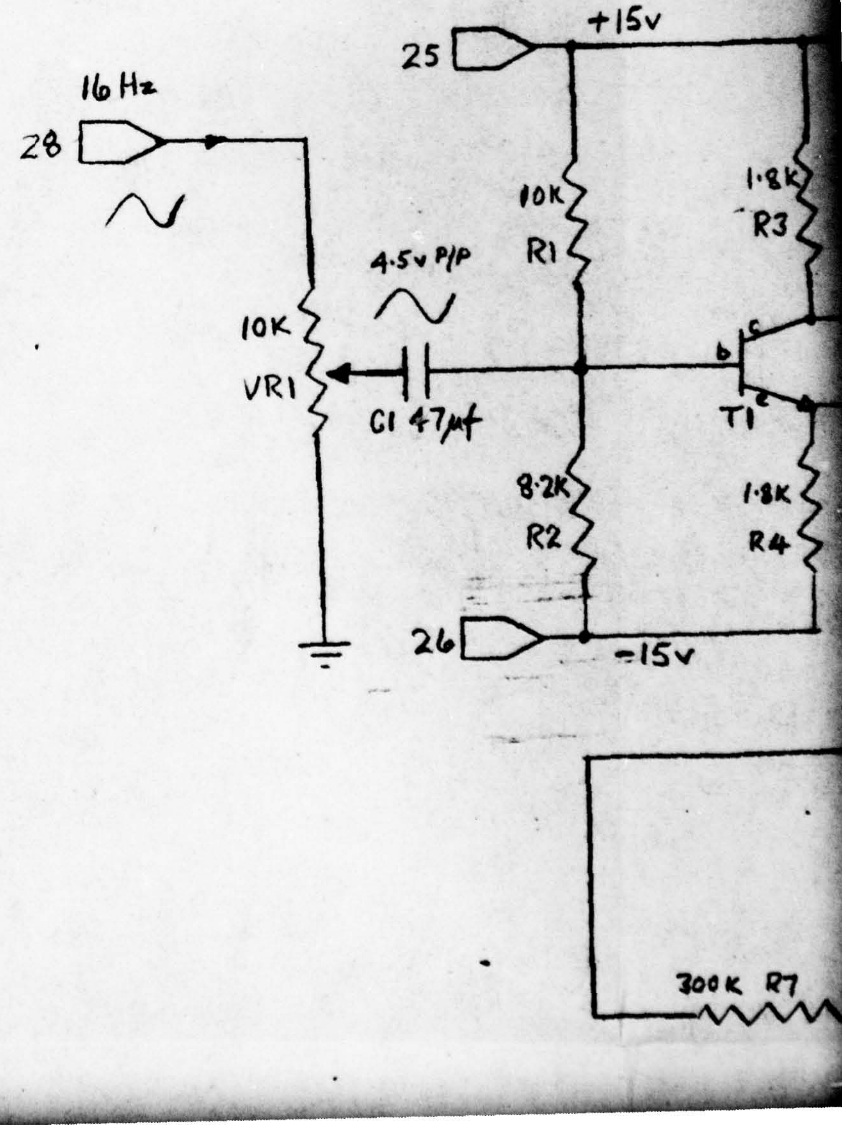
TITLE: BALANCED AMPLITUDE

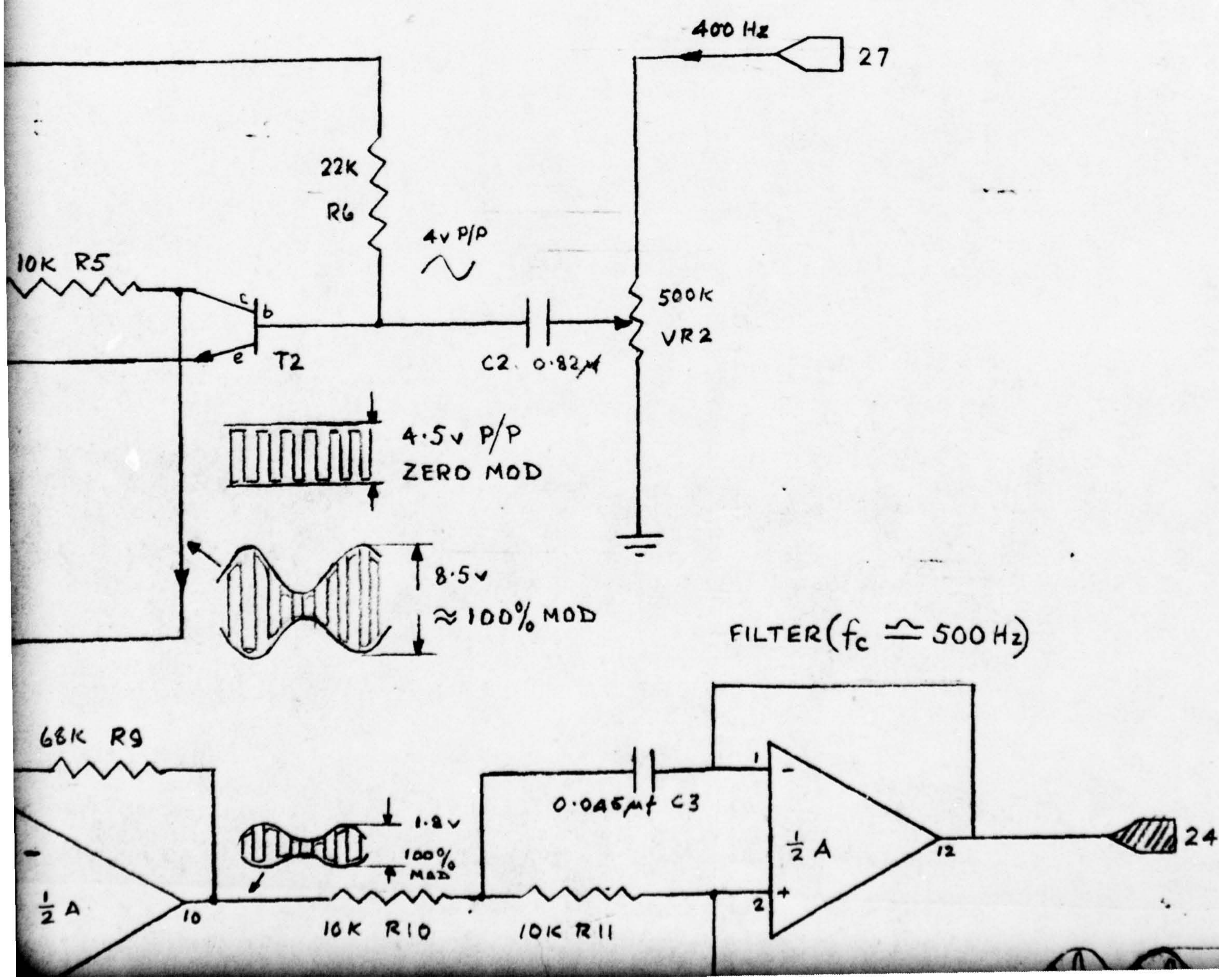
SCALE

DIVISION

APPROVAL

AERONAUTICAL

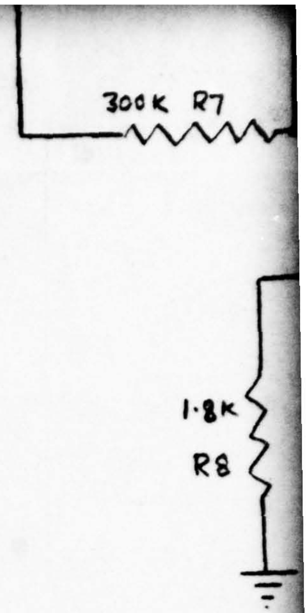



400 Hz
27
22K
R6
4v P/P
10K R5
c
b
e
T2
500K
VR2
C2 0·82µf
4·5v P/P
ZERO MOD
8·5v
≈100% MOD
FILTER(f_c ≃ 500 Hz)
68K R9
1
2
0·045µf C3
1·8v
100% MOD
½ A
10
12
24
10K R10
10K R11

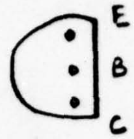
3

THIRD ANGLE PROJECTION

DO NOT SCALE



BOTTOM
VIEW
(T1 & T2)



	PACKAGE IDENTIFICATION	SUPPLY PIN CONN +15v	-15v
A	LM 747	9, 13	4
T1, T2	AY 1103	–	–

BOARD SIZE - M8

AMPLITUDE MODULATOR 57-262

AERONAUTICAL RESEARCH LABORATORIES – AUSTRALIA

DIVISION	AERO	DRAWN	SHC 10.10.76
APPROVAL		CHECKED	14.3.77
		APPROVED	15.3.77
GEN. ARRGT.		PARTS LIST	PL
DRG. No.	A2	REVISION No.	

4

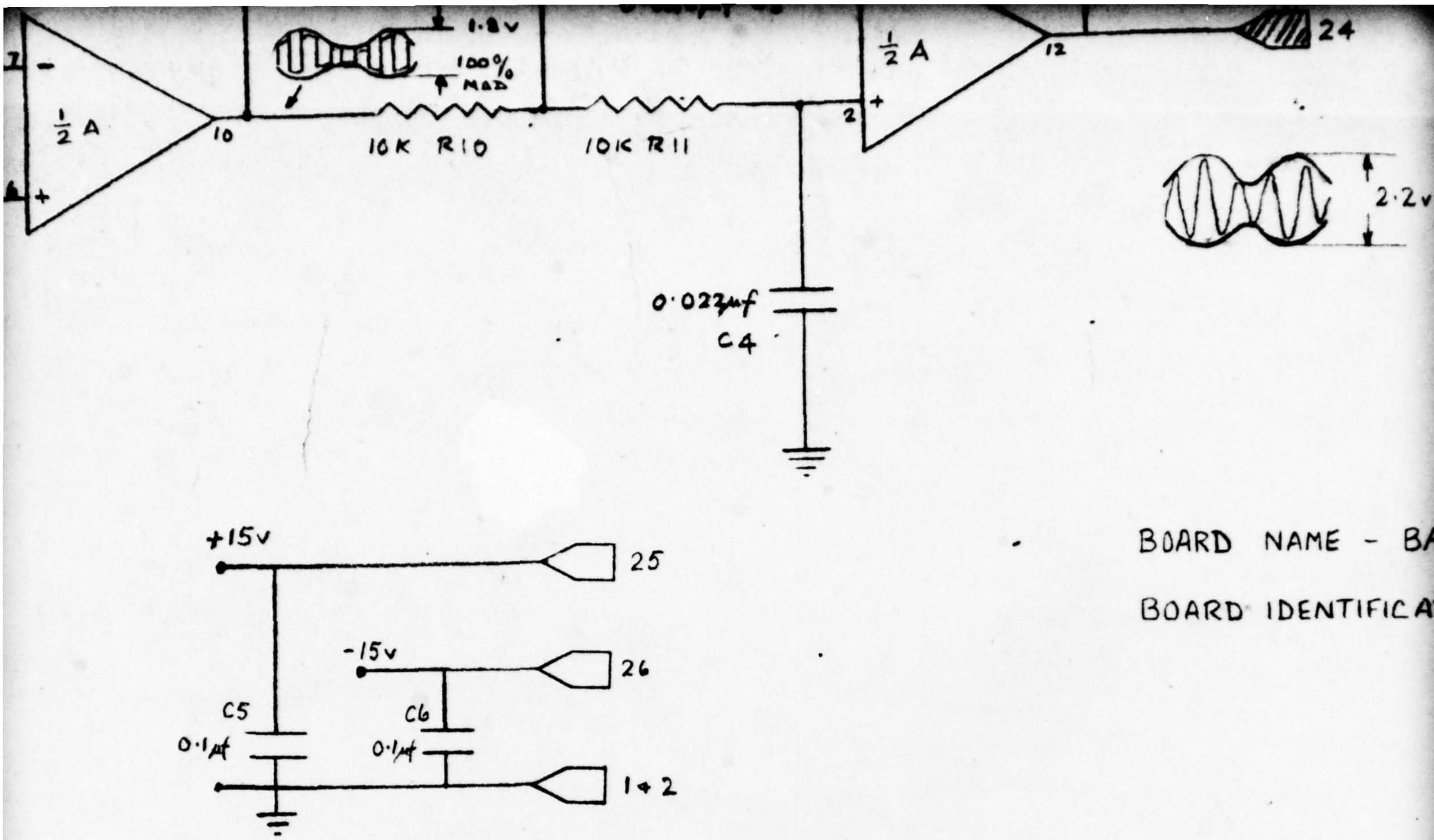


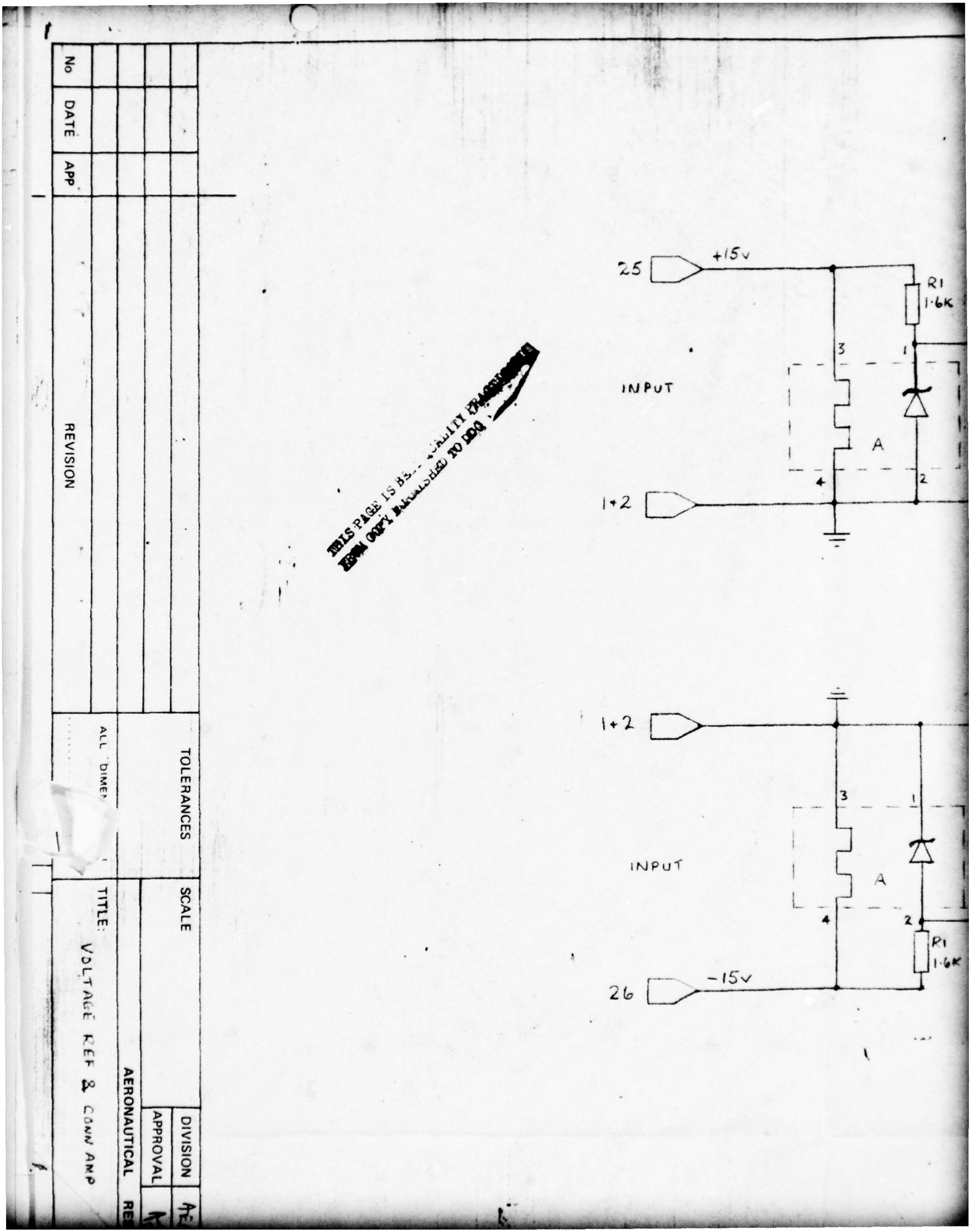
FIG. 3 MODULATORS

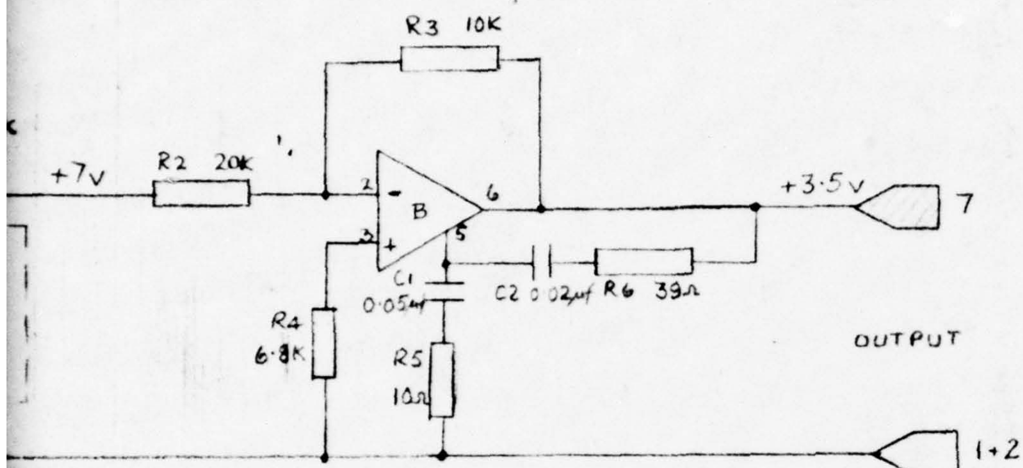
00% MOD

ANCED AMPLITUDE MODULATOR

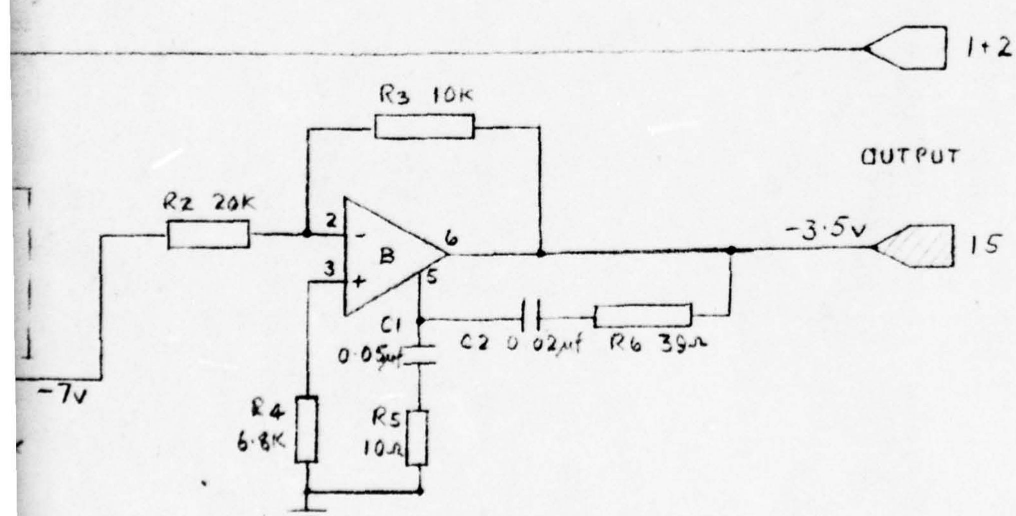
ON - 57-262

6

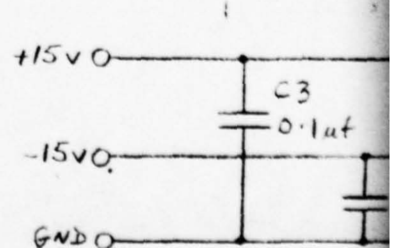

No
DATE
APP
REVISION
TOLERANCES
ALL DIMEN
SCALE
DIVISION
APPROVAL
AERONAUTICAL
TITLE:
VOLTAGE REF & CONN AMP
25
+15v
R1
1·6K
INPUT
A
1+2
1+2
INPUT
A
R1
1·6K
26
-15v

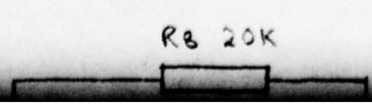


POSITIVE REFERENCE



NEGATIVE REFERENCE





3

THIRD ANGLE PROJECTION

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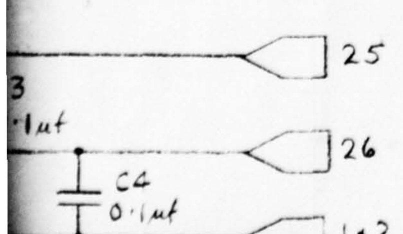
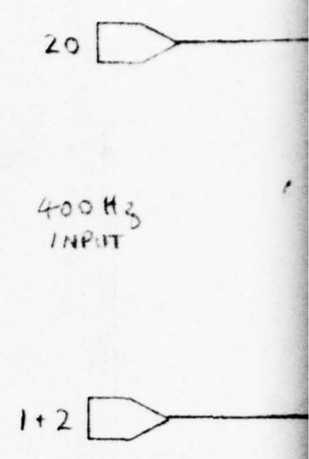


	PACKAGE IDENTIFICATION	SUPPLY PIN CONN +15V	-15V
A	LM399		
B	LM725	7	4
C	LM741	7	4

BOARD SIZE M8



FIG

DIVISION AEDO
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...AUTICAL RESEARCH LABORATORIES – AUSTRALIA

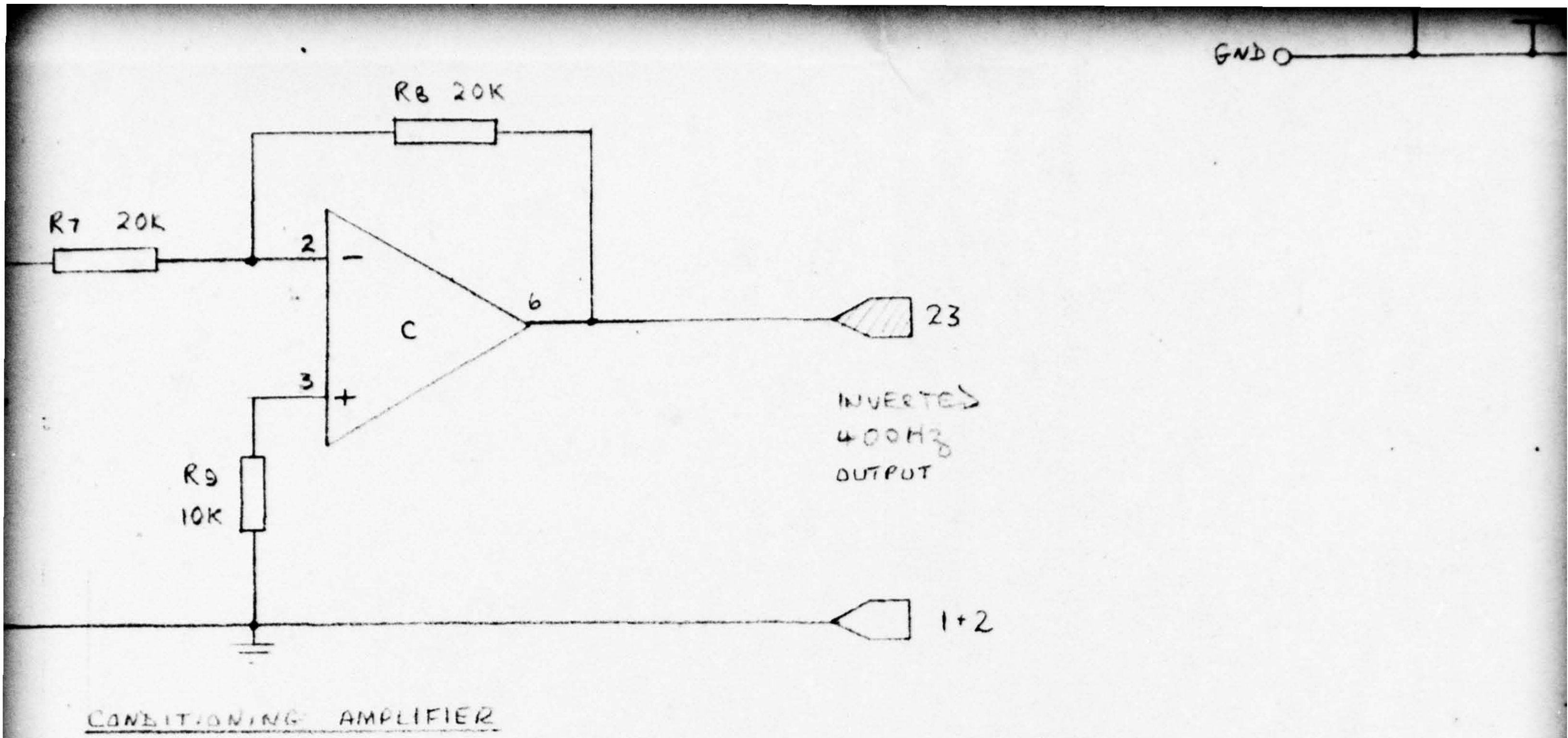
DRAWN		30.10.76
CHECKED		4.11.76
APPROVED		6.11.76

GEN. ARRGT.
PARTS LIST PL

...ONN AMP 57-280

DRG. No. A2

REVISION No.



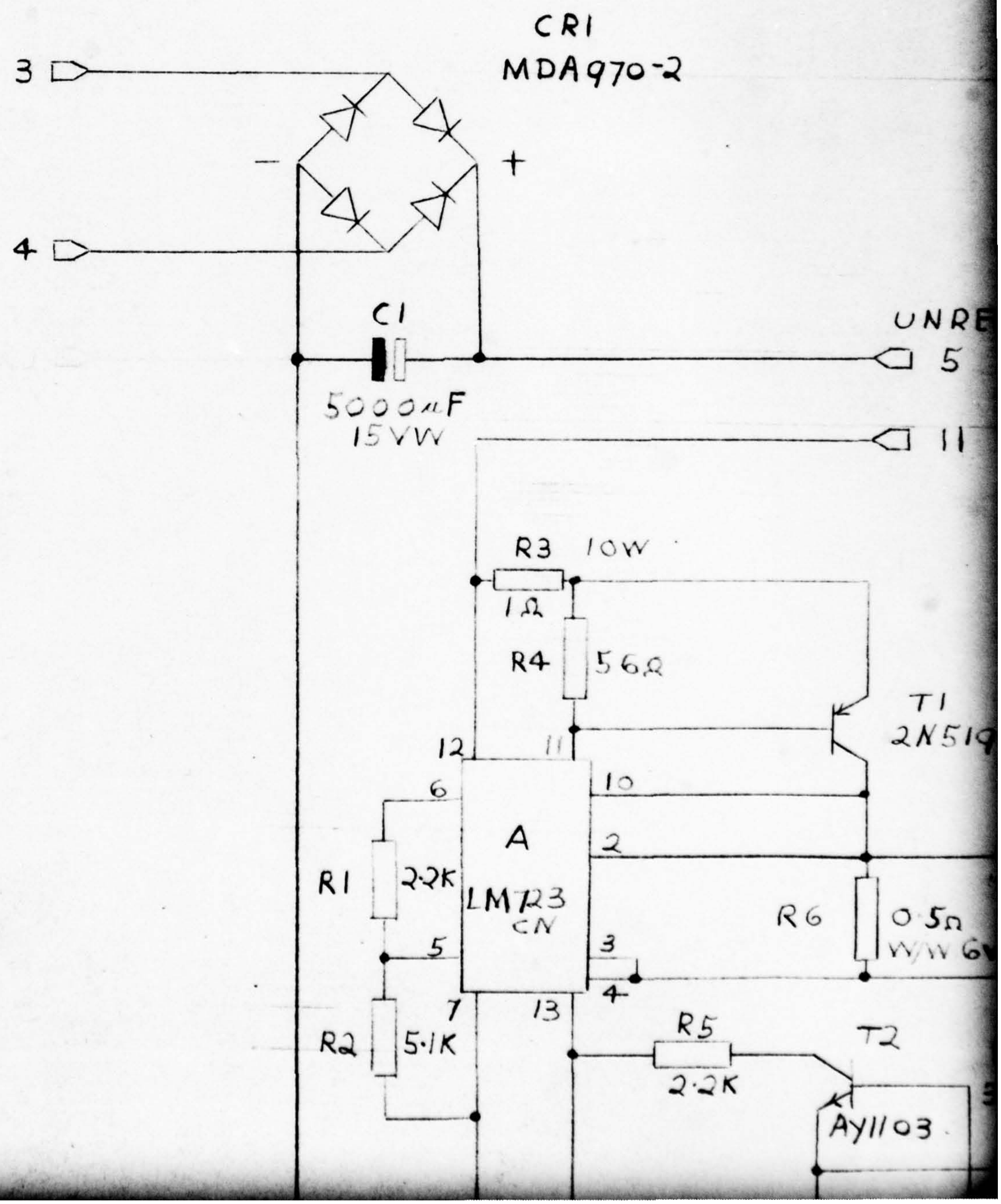
IG. 4 D.C. REFERENCE CIRCUIT

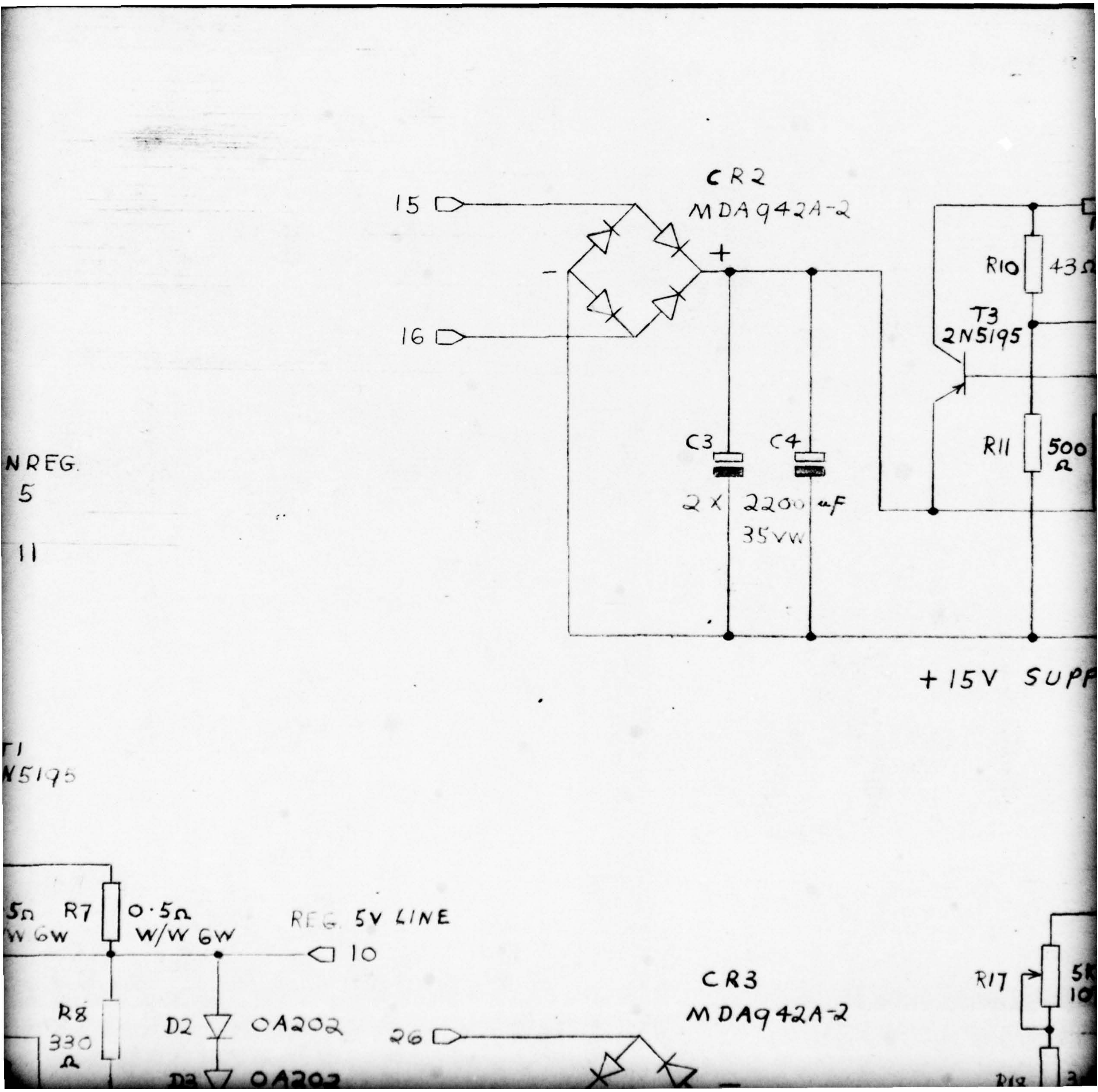
BOARD NAME - VOLTAGE REF & CON AMP

BOARD IDENTIFICATION - 57-280

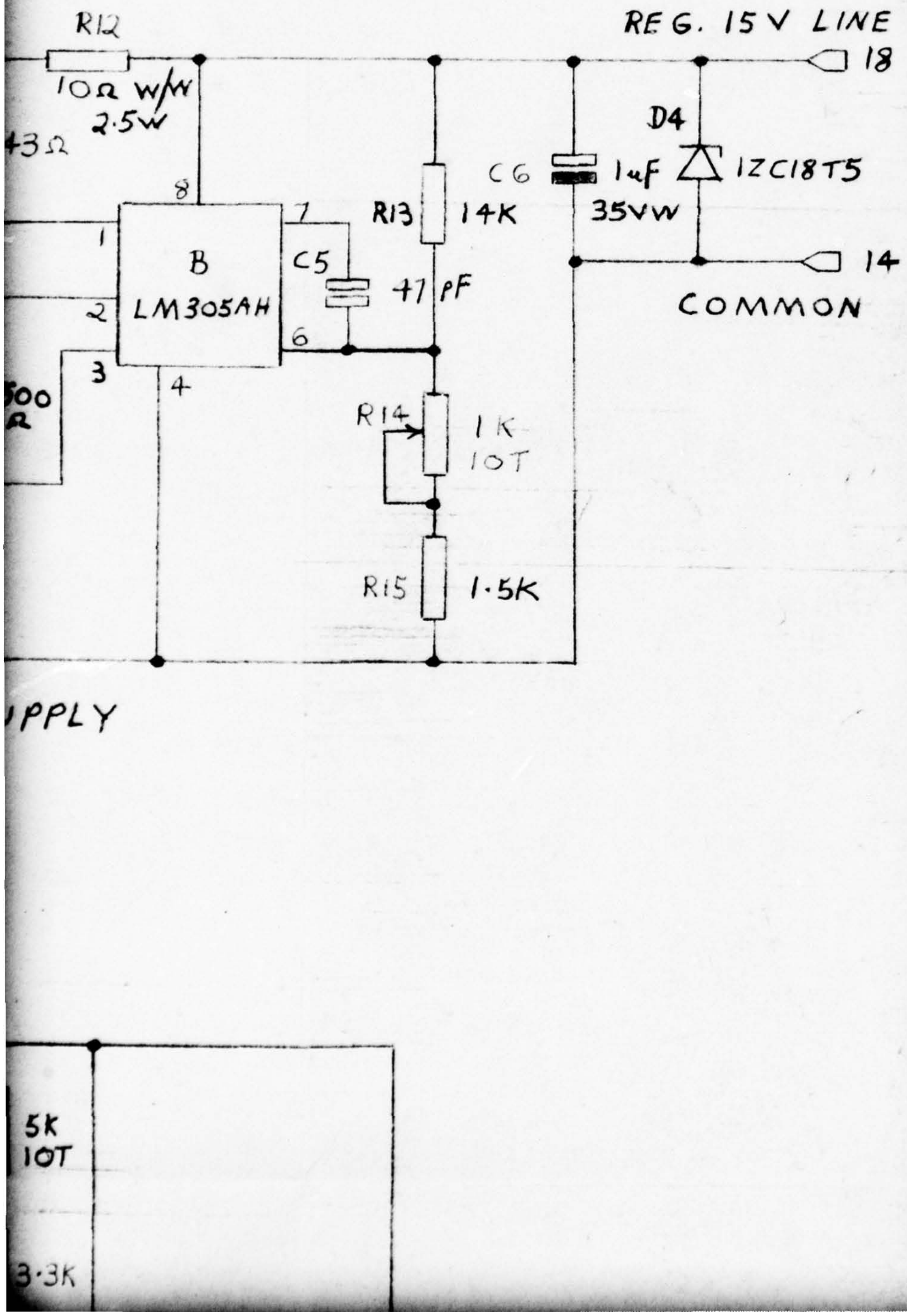
51

6

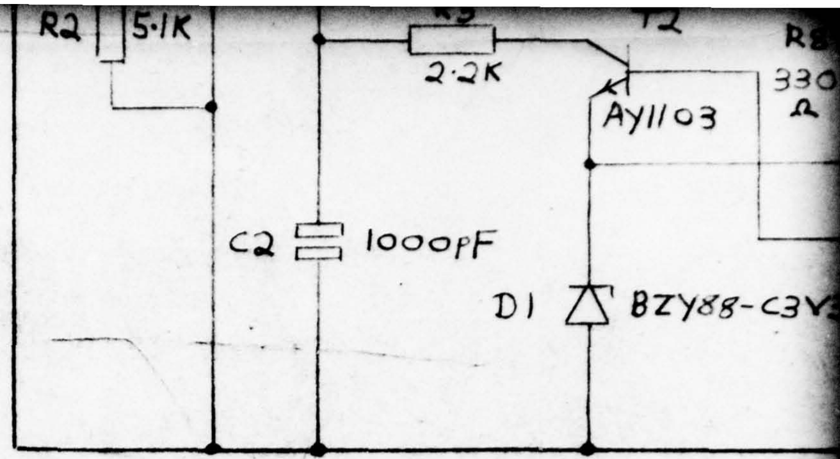

CR1
MDA970-2
3
4
-
+
C1
5000µF
15VW
UNRE
5
11
R3 10W
1Ω
R4 56Ω
T1
2N51
12
11
6
10
A
2
R1 2.2K
LM723
CN
R6 0.5Ω
W/W 6
5
3
4
7
13
R5
2.2K
T2
R2 5.1K
AY1103



CR2
MDA942A-2
15
16
+
-
C3
C4
2 X 2200 uF
35VW
R10
43Ω
T3
2N5195
R11
500 Ω
+15V SUPP
NREG.
5
11
T1
N5195
5Ω
W 6W
R7
0·5Ω
W/W 6W
REG. 5V LINE
10
R8
330 Ω
D2
OA202
D3
OA202
CR3
MDA942A-2
26
R17
5K
10



R12
10Ω W/W
2.5W
43Ω
REG. 15V LINE
18
D4
1ZC18T5
C6
1uF
35VW
R13
14K
8
7
1
2
3
4
6
B
LM305AH
C5
47 pF
14
COMMON
500
Ω
R14
1K
10T
R15
1.5K
UPPLY
5K
10T
3.3K



+5V 2A SUPPLY

+5 ~~VOLT~~ 2 AMP & DUAL 15 VOLT
REGULATED SUPPLIES

PRINTED CIRCUIT BOARD
IDENT No. 57-162

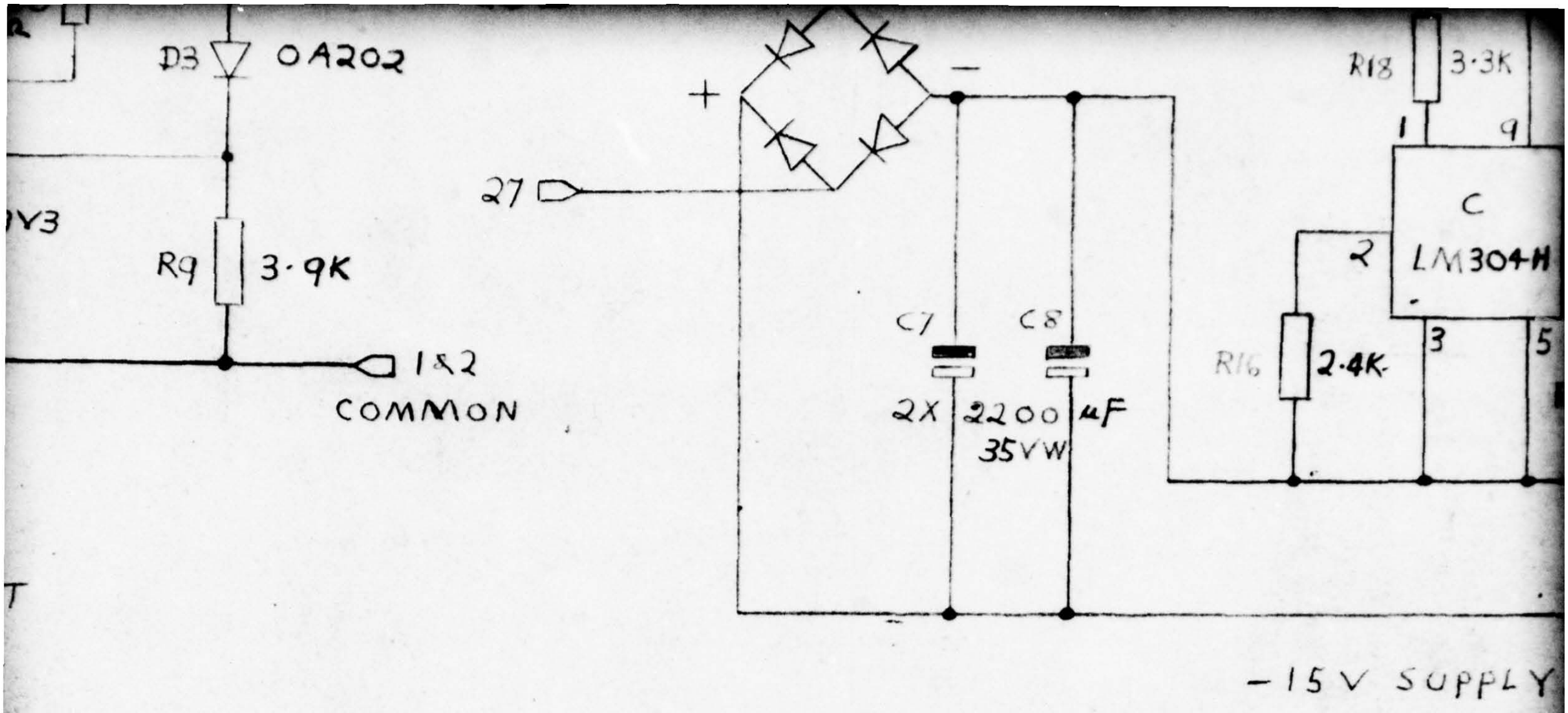
DRAWN	RJA	2-1-73
CHECKED		
APPROVED		
PASSED		

REVISION | App.

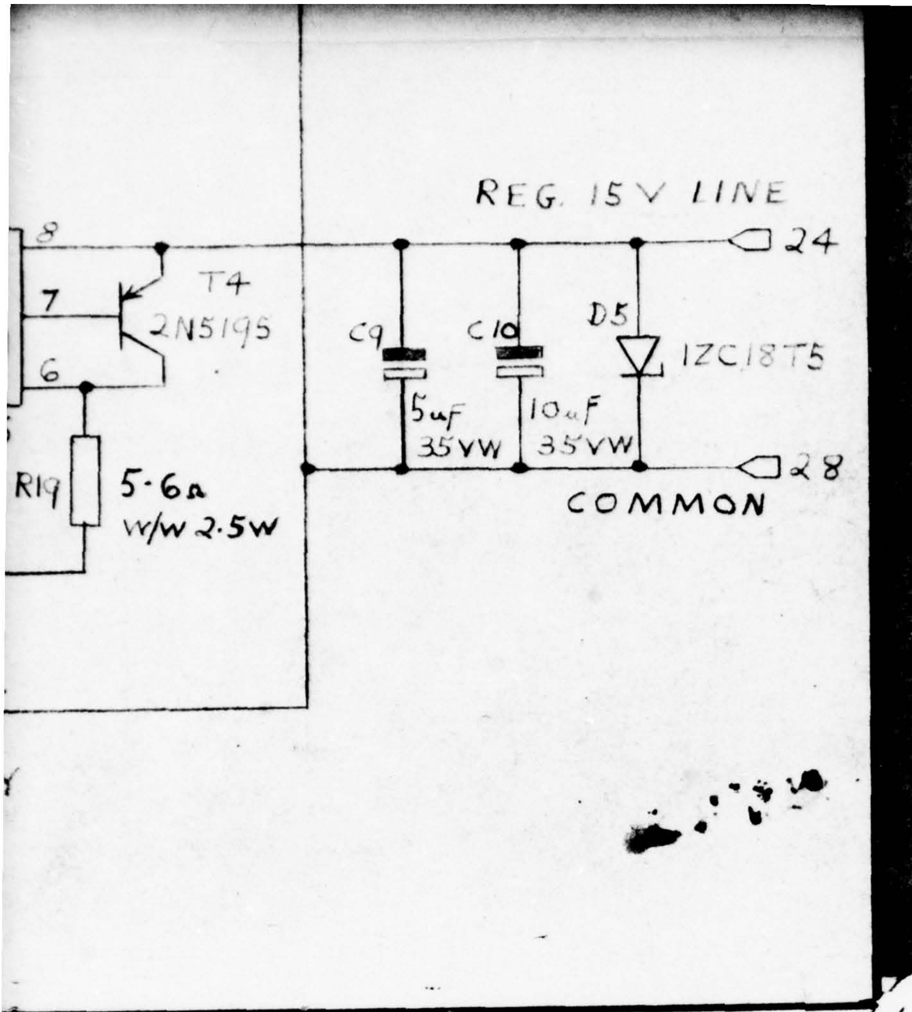
COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF SUPPLY
AERONAUTICAL RESEARCH LABORATORIES

SCALE

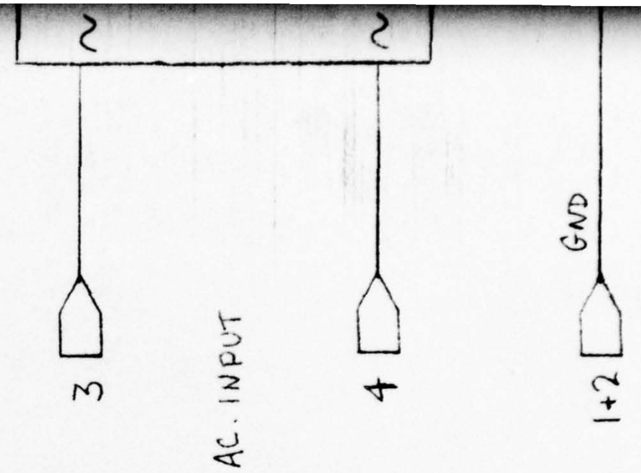
DRG. No. SK17270


D3 OA202
Y3
R9 3·9K
1&2
COMMON
27
+
−
C7 C8
2X 2200 uF
35VW
R18 3·3K
1 9
C
LM304H
2
3 5
R16 2·4K
T
−15 V SUPPLY

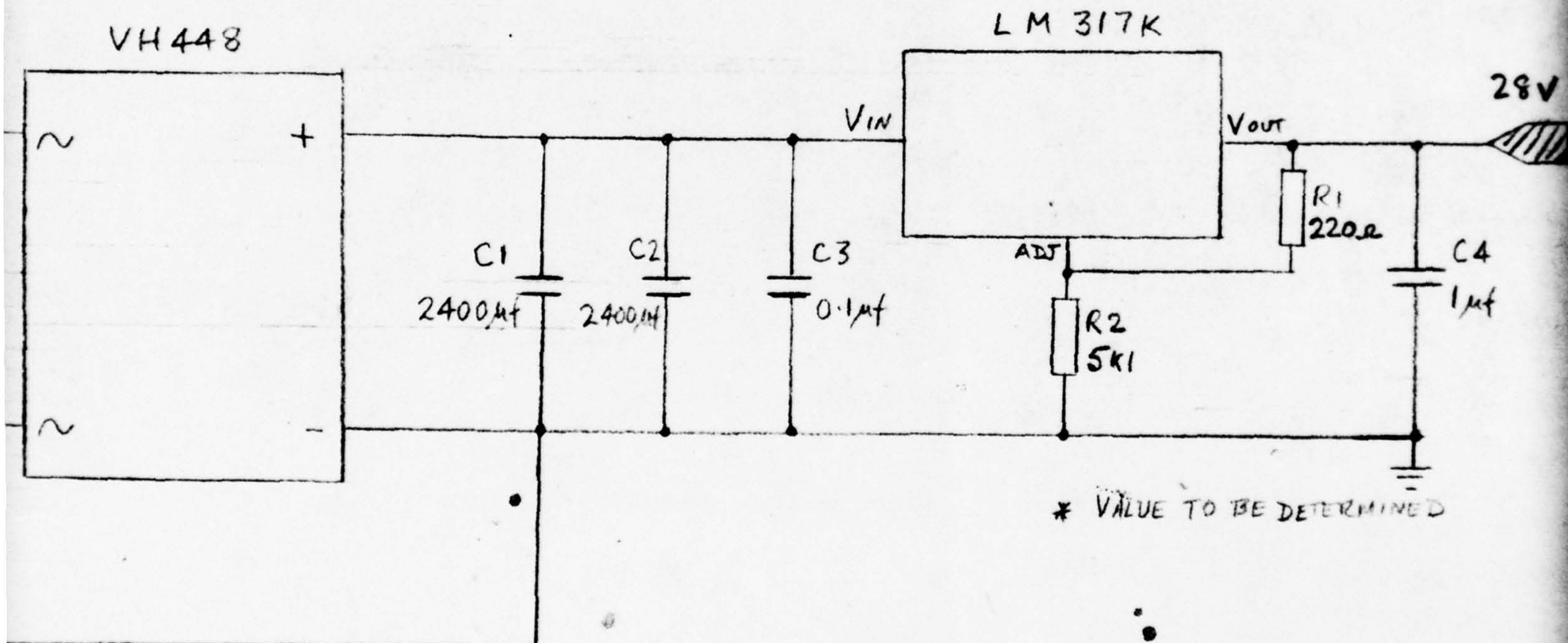
5


REG. 15V LINE
24
T4
2N5195
8
7
6
C9
C10
D5
1ZC18T5
5uF
35VW
10uF
35VW
28
COMMON
R19
5·6Ω
W/W 2.5W

16



No	DATE	APP	REVISION	TOLERANCES	SCALE	DIVISION
				ALL DIMENSIONS IN		APPROVAL
					TITLE: REGULATED 28v POWER SU	AERONAUTICAL


VH448
~
+
~
–
C1
2400μf
C2
2400μf
C3
0·1μf
LM 317K
VIN
VOUT
ADJ
R1
220Ω
R2
5K1
C4
1μf
28V
* VALUE TO BE DETERMINED

3

.8V

5

THIRD ANGLE PROJECTION

DO NOT SCALE

DIVISION	AECD	DRAWN	SHC	3.3.76	GEN. ARRGT.	
APPROVAL	RGC	CHECKED	RGC	9.3.76	PARTS LIST	PL
		APPROVED	RGC	10.3.76		

AUTICAL RESEARCH LABORATORIES – AUSTRALIA

OWER SUPPLY 57-290	DRG. No.		A2
	REVISION No.		

4

BOARD NAM

BOARD IDE

FIG. 6 + 28 VOLT SUPPLY

1

5 1

NAME - REGULATED 28V POWER SUPPLY

IDENTIFICATION - 57-290

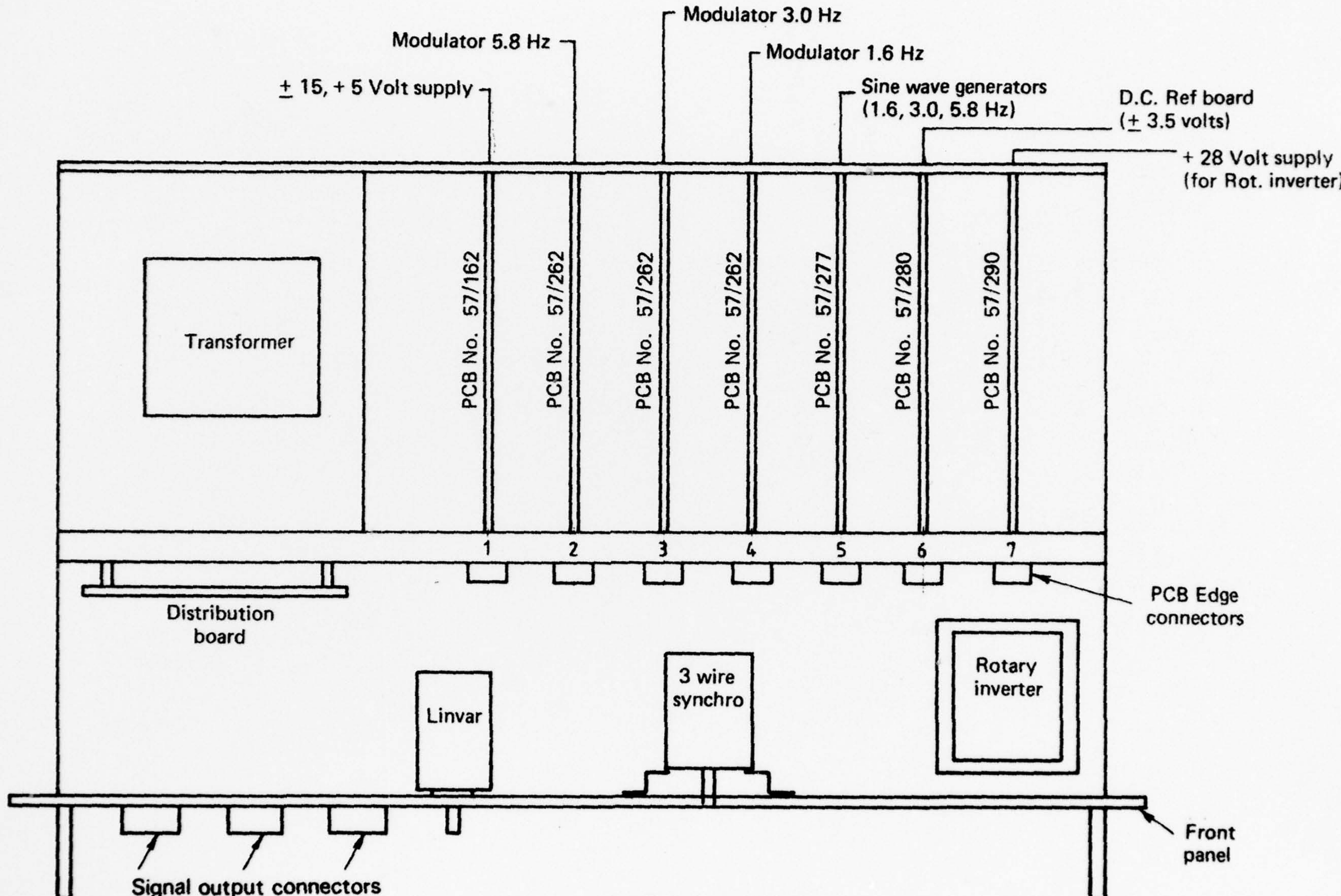


FIG. 7. PLAN VIEW OF UNIT

CIRCUIT PURPOSE / CONNECTOR IDENT.	+5, ±15 Volt Supply 57/162	Balanced Amplitude Mod. 57/262	Balanced Amplitude Mod. 57/261	Balanced Amplitude Mod. 57/262	Sine Wave Generator 57/277	DC Reference Board 57/280	+28 V Power Supply 57/290
CONNECTOR IDENT. Nº	1	2	3	4	5	6	7
GND	1	1	1	1	A	1	1
"	2	2	2	2	B	2	2
A.C (9V RMS)	3						
A.C (9V RMS)	4						
UNREG. D.C	5/11						
+5 Volt (NOT USED)	10						
COMMON (+15V)	14						
AC. (12V RMS)	15						
A C. (12V RMS)	16						
+15V	18	25	25	25	Y	25	
−15 V	24	26	26	26	W	26	
A.C (12V RMS)	26						
A.C (12V RMS)	27						
COMMON (−15V)	28						
400 Hz ROT INVERTER		27	27	27			
1·6 Hz SINE WAVE				28	T		
3 0 Hz			28		BB		
5 8 Hz		28			AA		
400Hz MOD 1·6 Hz (o/p)				24			

2 1 3

1·6 Hz SINE WAVE			28	T		
3·0 Hz		28		BB		
5·8 Hz	28			AA		
400Hz MOD 1·6 Hz (O/P)			24			
" MOD 3·0 Hz (O/P)		24				
" MOD 5·8 Hz (O/P)	24					
+28 VOLTS						5
AC						3
AC						4
−3·5V REFERENCE (O/P)						15
+3·5V REFERENCE (O/P)					7	

DRAWN P.F 13/10/77
CHECKED
APPROVED
PASSED

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COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF SUPPLY
AERONAUTICAL RESEARCH LABORATORIES

SCALE

DRG No

FIG. 8 LOOM DI

4

DIAGRAM FOR TEST AND CALIBRATION UNIT

6

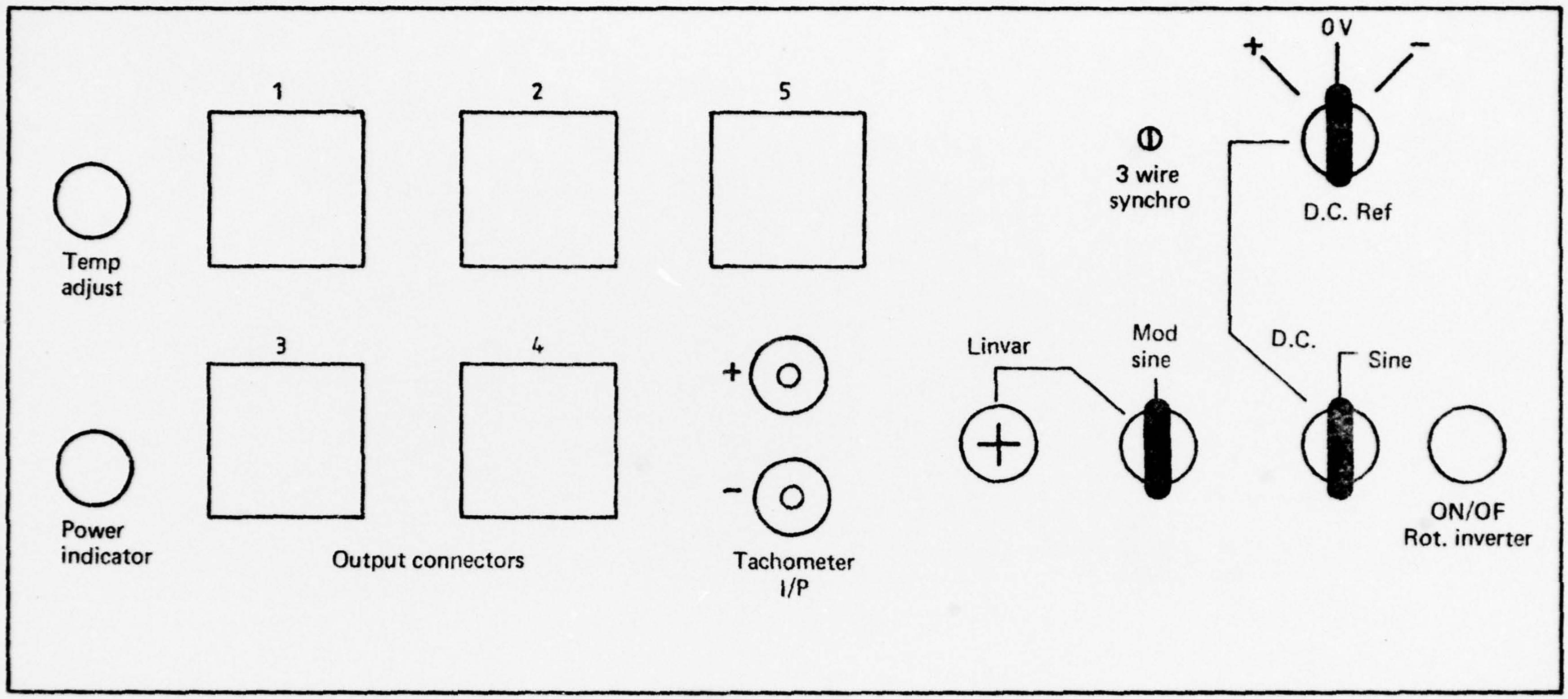

FIG. 9. FRONT PANEL LAYOUT

DOCUMENT CONTROL DATA SHEET

Security classification of this page: UNCLASSIFIED

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   a. AR Number: AR-001-601
   b. Document Series and Number: Aerodynamics Technical Memorandum 312
   c. Report Numbers: ARL-AERO-TECH-MEMO-312

2. SECURITY CLASSIFICATION
   a. Complete document: UNCLASSIFIED
   b. Title in isolation: UNCLASSIFIED
   c. Summary in isolation: UNCLASSIFIED

3. TITLE:

THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TEST AND CALIBRATION UNIT.

4. PERSONAL AUTHOR:

P. FERRAROTTO

5. DOCUMENT DATE: MARCH, 1979

6. TYPE OF REPORT AND PERIOD COVERED: TECH. MEMO.

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12-0. OVERSEAS:	NO		P.R.	1	A		B		C		D		E

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14. DESCRIPTORS:

Data acquisition.
Calibrating.
Measuring instruments.
Test equipment.
Flight tests.

15. COSATI CODES:

0102
1402

16. ABSTRACT:

This unit was constructed specifically for the purpose of testing and calibrating the Aerodynamics Division Airborne Data Acquisition Package. The unit consists of sine wave generators, modulators and miscellaneous circuits which generate test signal outputs for checking the data acquisition system.

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